"INTRODUCTION TO WATERSHED MANAGEMENT"

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Abstract: ***The problem of degraded land, water and its management is complex and multi-dimensional and its development aims to develop human resource in watershed development and management and generate awareness about the importance of sustainable development and maintenance of existing work force working in the watershed development and develop skill in the rural youth to work in the watershed development based on watershed management approach and developing natural resources on sustainable basis.***

Introduction

A watershed is the area that drains to a common outlet. A watershed is a building block for land and water resourse planning. In last few decades the degradation of watershed has brought a long term effect on the quality and quantity of land and water. Changes are observed in various factors like soil erosion, farming system, over exploitration, overgrazing, pollution and deforestation. Watershed management is the integrated use of land, vegetation and water in a geographically discrete drainage area for the benefit of its residents, with the objective of protecting or conserving the hydrologic services that the watershed provides and of reducing or avoiding negative downstream or groundwater impacts.

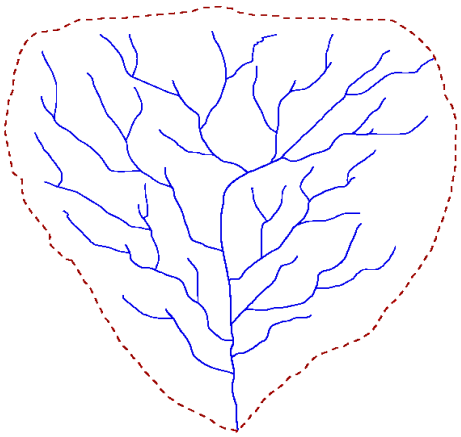


Fig 1 : Typical Watershed

Management of the environment has been primarily focussed on specific issues such as air, land, and water. Most efforts have

resulted in decreasing pollutant emissions to air and water, improved landfills, remediation of waste sites and contaminated groundwater, protection of rare and endangered species, design of best management practices to control water and contaminant runoff, and much more.

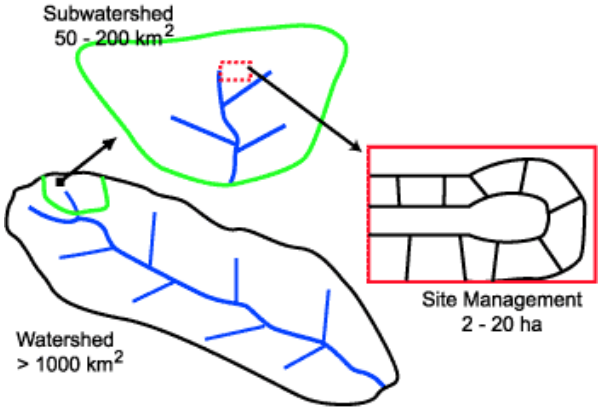
Importance of Watershed Management

Watersheds are important because the surface water features and stormwater runoff within a watershed ultimately drain to other bodies of water. It is essential to consider these downstream impacts when developing and implementing water quality protection

and restoration actions. Everything upstream ends up downstream. We need to remember that we all live downstream and that our everyday activities can affect downstream waters.

The groundwater resources in the State of Maharashtra have various limitations, mainly attributed to typical physiographical, geological and hydro-geological conditions coupled with vagaries of monsoon . Geologically, most of the State (about 80 % areas) is covered by hard rock formation of Deccan trap basalt, and 33 % of geographical area is occupied by hilly portion (CGWB 2003). As a result, the State experiences drinking water scarcity problem. The scarcity situation at a time is alarming and therefore demands adoption of appropriate water conservation techniques. To combat such situation, it has become necessary to identify, develop and implement the groundwater recharge systems. For this, implementations of appropriate water conservation measures to capture the rainwater runoff have become essential. Realizing this fact, the Government of Maharashtra is embarked upon implementation of water conservation through watershed development programs. However, most of the time, the programs lack multidisciplinary approach due to which the desired impact is not achieved. Thus, there exists a
demand for development of geospatial technique for estimating watershed characteristics.

The logical sequence of water management plan should be watershed plan, subwatershed plan, and site plan. The relationships between these planning levels are illustrated in the following diagram.



Problems Associated with Watersheds

- Flooding
- Unstable Slopes / Land Slides
- Erosion from Denuded Land
- Deficient Water Supplies
- Energy Shortage
- Food Shortage
- Poor Quality Drinking Water
- Polluted Streams / Reduced Fishing
- Sedimentation of Navigation Tracks.
- Timber Shortage (for Dwelling Purposes)

Types of Watershed Management

Watershed is classified depending on the size, drainage, shape and land use pattern.

- Macro watershed:1000-10000 ha
- Micro watershed: 100-1000 ha
- Mini watershed: 10 -100 ha
- Mille watershed: 1 -10 ha

Main Components of Watershed

- Soil and water conservation
- Water harvesting and water management
- Alternate land use system.

Steps in Watershed Management

Watershed management involves determination of alternative land treatment measures for, which information about problems of land, soil, water and vegetation in the watershed is essential. In order to have a practical solution to above problem it is necessary to go through four phases for a full scale watershed management.

Programme:

- Recognition phase
- Restoration phase
- Protection phase
- Improvement phase

- Recognition Phase:

It involves following Recognition of problem ,analysis of the cause of the problem and its effect and Development of alternative solutions of problem

- Restoration Phase:

It includes two main steps.Selection of best solution to problems identified and application of the solution to the problems of the land

- Protection Phase:

This phase takes care of the general health of the watershed and ensures normal functioning. The protection is against all factors which may cause determined in watershed condition.

- Improvement Phase:

This phase deals with overall improvement in the watershed and all land is covered. Attention is paid to agriculture and forest management and production, forage production and pasture management, socio economic conditions to achieve the objectives of watershed management.

The various measures adopted under soil and water harvesting is:Vegetative barriers, building of contour bunds along contours for erosion,furrow/Ridges and Furrow ridge method of cultivation across the slope, irrigation water management through drip and sprinkler methods and planting of horticultural contour species on bunds.

Watershed Management Practices

A. In Terms of Purpose to increase infiltration, to increase water holding capacity and to prevent soil erosion

B. Method and Accomplishment:

- Vegetative measures/Agronomical measures:Strip cropping,pasture cropping ,grass land farming and woodlands
- Engineering measures/Structural practices:contour bunding, terracing, construction of earthen embankment, construction of check dams, construction of farm ponds, construction of diversion, gully controlling structure, rock dam, establishment of permanent grass and vegetation and providing vegetative and stone barriers

TYPES OF WATER CONSERVATION STRUCTURES

BROAD BEDS AND FURROWS

a.FUNCTION

To control erosion and to conserve soil moisture in the soil during rainy days.

b. GENERAL INFORMATION

The broad bed and furrow system is laid within the field boundaries. The land levels

taken and it is laid using either animal drawn or tractor drawn ridgers.

c.COST

Approximate cost for laying beds & furrows is Rs.1800 / ha.

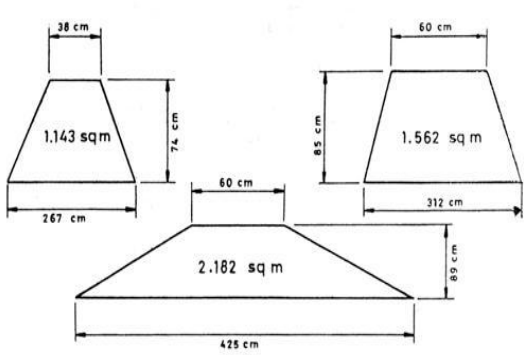
d. SALIENT FEATURES

- Conserves soil moisture in dryland
- Controls soil erosion.
- Acts as a drainage channel during heavy rainy days.

2. CONTOUR BUND

a. FUNCTION

To intercept the run off flowing down the slope by an embankment.



CONTOUR BUND

Contour bunding

b. GENERAL INFORMATION

It helps to control run off velocity. The embankment may be closed or open, surplus arrangements are provided wherever necessary.

c. COST

Approximate cost of laying contour bund is Rs.1400 / ha.

d. SALIENT FEATURES

i. It can be adopted on all soils

ii. It can be laid upto 6% slopes.

iii. It helps to retain moisture in the field.

3. BENCH TERRACING

a. FUNCTION

It helps to bring sloping land into different level strips to enable cultivation.

b. GENERAL INFORMATION

It consists of construction of step like fields along contours by half cutting and half filling. Original slope is converted into level fields. The vertical & horizontal intervals are decided based on level slope.

c. COST

Approximate cost for laying the terrace is Rs.5000 / ha.

d. SALIENT FEATURES

- Suitable for hilly regions.
- The benches may be inward sloping to drain off excess water.
- The outward sloping benches will help to reduce the existing steep slope to mild one.
- It is adopted in soils with slopes greater than 6%

4. MICRO CATCHMENTS FOR SLOPING LANDS

a. FUNCTION

It is useful for insitu moisture conservation and erosion control for tree crops.

b. GENERAL INFORMATION

c. COST

Technique	**Cost/ha (Rs.)**
Triangular catchments (V-Bunds)	6000-7000
Crescent bunds	2500-3000

d. SALIENT FEATURES

- Slope ranges from 2 –8%
- Soil type – Light to moderate texture
- Insitu moisture conservation with staggered planting
- Suitable for dry land Horticulture & Agroforestry
- Bund height – 30 to 45 cm.

5. Check dam

Salient features

- A low weir normally constructed across the gullies
- Constructed on small streams and long gullies formed by erosive activity of flood water

- It cuts the velocity and reduces erosive activity
- The stored water improves soil moisture of the adjoining area and allows percolation to recharge the aquifers
- Spacing between the check dams water spread of one should be beyond the water spread of the other
- Height depends on the bank height, varies from a metre to 3 metre and length varies from less than 3m to 10m
- Cost varies from Rs. 40000/- to Rs. 100000/- per unit

6. Percolation pond:

Function

To augment the ground water recharge

Salient features

- Shallow depression created at lower portions in a natural or diverted stream course
- Preferable under gentle sloping stream where narrow valley exists
- Located in soils of permeable nature
- Adaptable where 20-30 ground water wells for irrigation exist with in the zone of influence about 800 – 900m
- Minimum capacity may be around 5000 m3 for the sack of economy
- Also act as silt detention reservoir
- Cost varies from Rs. 60000 to 150000 per unit

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